

Description

A drum drive with damping device for damping vibrations

The present invention relates to a damping device for damping vibrations from a drum drive.

5

In installations where conveyor belts are used and where a compact and space-saving exterior are demanded, drum drives of the type described below are widely used. It may be eg point-of-sales terminals in supermarkets, where drum drives drive the conveyor belt for transporting goods to a point-of-sales operator for registration, and in other conveyor belts for transportation of goods away from the point-of-sales operator. In operation, drum drives of the prior art type causes low-frequency vibrations in the area around the frequency of the supply voltage, and these vibrations transplant from the electromotor via the shaft into the supporting element where they bring about noise pollution. The vibrations vary with the load on the electromotor, and it will be understood that a loaded conveyor belt in operation will emit more noise than an unloaded conveyor belt, whereby the use of drum drives for conveyor belts in connection with point-of-sales terminals will cause the point-of-sales operator who operates such terminal to experience relatively much noise pollution. Therefore, the procedure was previously to mount the shaft of the drum drive in a damping suspension device on the supporting element. That solution is disadvantageous as it is rather time-consuming to mount the drum drive on the supporting element and, likewise, more mounting space is required.

The present invention aims to solve the problems that have so far been associated with the use of drum drives in connection with conveyor belts for eg point-of-sales

25

terminals, where the space for mounting on the supporting element is limited and where the demands to a drum drive mounted with a low level of noise and vibrations are high. This is achieved as featured in the characterising part of claim 1, advantageous embodiments being featured in the dependent patent claims.

5

A conventional drum drive is taught in Danish utility model registration No. 96 00125. Usually such drum drive comprises an essentially cylindrical drum of eg iron or stainless steel and having end caps and delimiting an internal space intended for receiving an electromotor for producing a rotating movement of the drum. The
10 electromotor comprises a stator, a shell and a stator cap. Through the end caps a fixed shaft extends that is confined for being mounted on a supporting element. Drum drives of the described type conventionally lend themselves for use in connection with transport plants with a conveyor belt of a rubber material that abuts directly on the cylindrical drum and is advanced by friction when the drum rotates in
15 relation to the fixed shaft.

The damping device according to the invention is intended for being mounted on the fixed shaft and for forming a flexible connection between the fixed shaft and the stator or stator cap of the electromotor. The damping device can preferably be
20 formed with a centre element intended being secured against rotation on the fixed shaft, from which a spring element integral with the centre element extends. Apart from that, the spring element has connecting means for connecting the damping device to the stator or the stator cap. The stator and the shell are connected to each other and are turnably journaled on the shaft. Interiorly of the shell the rotor part of
25 the electromotor is provided and the rotor influences the stator with a reaction force. It is the object of the invention to dampen the reaction forces produced in the shaft due to variations in this reaction force during operation of the electromotor. The spring element acts as a flexible connection and serves to absorb vibrations from the electromotor and prevents the latter from transplanting via the fixed shaft into the
30 supporting element.

With the damping device according to the invention it is also obtained that the spring

element for a given power impact on the connecting means will flex in response to a thrust impulse and absorb the impacts produced by eg the starting momentum of the drum drive during starting up.

5 The invention will now be described in further detail with reference to the drawing, wherein

Figure 1 shows a preferred embodiment of the invention in a sectional view of a prior art drum drive with damping device; and

10

Figure 2a shows in the plane an embodiment of the damping device; and

Figure 2b is a sectional view through the embodiment shown in Figure 2a; and

15 Figure 3 shows the embodiment shown in Figure 2 of the damping device, wherein the spring elements are compressed in an extreme position in response to a force applied at the connecting means.

20 Figure 1 is a sectional view of a drum drive with shell (2), a stator cap (3), a fixed shaft (7), and a damping device (10) and illustrates how the damper device (10) is mounted for transfer of momentum between the shaft (7) and the stator cap (3) of the electromotor. The damping device (10) is mounted on the shaft (7) with securing means (not shown) that engage in a recess (15) in a centre element (11) and are secured to the stator cap (3) via connecting means (21, not shown) and via coupling
25 means are introduced into recesses intended therefor in the stator cap (3) for transfer of turning momentum between the stator cap (3) and the shaft (7) and further into a supporting frame.

30 Exteriorly around the shell shown in Figure 1, there is in a conventional manner mounted a not shown cylindrical drum, whereby the drum drive appears with the configuration taught in Danish utility model No. 96 00125.

The stator cap (3) and the shell (2) are connected to each other and are turnably journalled on the shaft (7). Interiorly in the shell (2) the rotor part (not shown) of the electromotor is provided, and the rotor influences the stator with a reaction force. During operation of the electromotor the reaction force on the stator/the shell (2) must be transferred to the shaft (7).

The following description refers to Figures 2a and 2b that are more detailed views of a preferred embodiment of an integrally moulded damping device (10) of a plastics or rubber material, comprising a centre element (11) having a central circular opening (12) with centre (13), configured for enclosing a shaft (not shown) of the type used in a drum drive (not shown). Extending from centre (13) of the central opening (12) a first longitudinal axis (8) extends in the plane and a second longitudinal axis (9) under an angle of 180° . Coinciding with the central circular opening (12) the damping device features a recess (15) that will, in connection with an opening in the not shown shaft (7) and a tap-shaped securing means (not shown), ensure transfer of a turning momentum between the damping device (10) and the shaft and further out into a supporting frame (not shown).

The centre element (11) is connected to a first connecting element (20a) by means of a spring element (18a) comprising segments (31) that extend essentially at right angles to the first axis (8) that protrudes from a first transition part (30) in the plane from one side of the centre element (11) at right angles to the first axis (8). From an opposite side, the centre element (11) is connected to a second connecting element (20b) via a spring element (18b), comprising segments (31) that protrude essentially at right angles to a second axis (9) and with an expanse in the plane, and extending from a second transition part (30). The segments (31) are connected to each other and to the connecting element (20a, 20b) via transition parts (30), such that said segments (31) and the transition parts (30) combine to form a zigzag shape.

The connecting element (20a, 20b) is formed essentially symmetrically about the axis (8, 9) and comprises connecting means (21) having an expanse at right angles to the plane, by means of which the connecting element (20a, 20b) is connected to

the stator cap of the motor.

Figure 3 shows the damping device (10) shown in Figure 2 and illustrates how the segments (31) in the spring elements (18a, 18b) can flex by an impact applied to the connecting means (21) in the direction of rotation during operation of the motor, where the rotor influences the stator by a rotational force.

In the figure the spring elements (18a, 18b) are flexed within material tolerances, whereby the individual segments (31) touch/are in contact with a part of a surface of super- or subjacent parts (segments (31)), the connecting element (20a, 20b) and centre element (11)), respectively, in the flexing direction opposite the side onto which an impact is applied.

The spring elements (18a, 18b) are intended for absorbing the impact on the connecting elements (20a, 20b) and, for the given impact, they will flex against the direction of rotation of the rotor and will, in particular when the drum drive starts up, they will reduce the impact impulse provoked by the starting momentum during starting up.

It will be understood, that the damping device (10) will, when an impact on the connecting means (20a, 20b) ceases, in the direction of rotation of the rotor, assume the shape shown in Figure 2, the segments (31) being made of an elastic material, and that operation is carried out within the elastic, non-permanent tolerance area of the material in question.

It will also be understood that the spring elements (18a, 18b) will advantageously be configured such that rigidity is provided in the individual segments (31) that decrease with the distance from the centre (13) of the circular opening (12) towards the connecting elements (20a, 20b) and that thereby an even flexing of the spring element (18a, 18b) is provided. Thereby a comparatively even distribution of force is also obtained across the spring elements (18a, 18b) and a more uniform load on the material. This variation in the rigidity may be provided for example by a change the

material thickness. Likewise, it will be possible to provide the difference in rigidity and thus the flexing of the individual spring elements (18a, 18b) by configuring them with an expanse essentially at right angles to the axis (8,9) that will, for the individual segment (31), decrease towards the connecting elements (20a, 20b).

5

In some situations, the damping element (11) will, when the drum drive starts up, be loaded with a powerful starting momentum that can be as much as 6 -8 times the momentum load during operation. This starting momentum may give rise to a particularly powerful load on parts of the damping element and in particular the spring elements (18a, 18b) that may cause the segments (31) to be loaded in excess of their material tolerances, thereby causing them to rupture. In order to avoid such material ruptures the centre elements (11) may advantageously be formed with coupling means (14) extending at right angles to the plane symmetrically about the central circular opening (12) and in the same direction as the connecting elements (21). These coupling elements (14) are destined for engaging with a recess in the stator cap of the electromotor and will, when the damping device (10) is turned about the centre (13) in the area +/- (plus/minus) 2-10° and preferably +/- (plus/minus) 5° from an unloaded starting position abut on an edge intended therefor in the recess on the stator cap (3) of the electromotor or on another recess with the same function on the stator. Thereby it is ensured that the starting momentum of the electromotor will for a first part be absorbed by the spring elements (18a, 18b) that will flex in response to the load within allowable material tolerances. Thereby it will be understood that for elevated values of the starting momentum and thus flexings of segments (31) within the allowable material tolerances, a modest further flexing of the segments (31) will take place before the coupling elements (14) will engage with the face in the recess intended therefor and cause the starting momentum to be absorbed in the coupling elements (14) that will thus relieve the spring elements (31) and counteract an unintentional load and optionally material ruptures. In this situation the spring elements dampen the impact from the starting momentum and hence the load on the material. Advantageously the spring elements could be formed of plastics material, rubber material or metal.

30

In Figure 2 the damping device is shown with the spring elements extending from transition parts (30) to the left of the axis (8, 9). Thereby it is obtained that the damping device (10) will have a vibration-damping effect that is independent of the current direction of the rotation of the electromotor. It will thus also be understood that, provided a vibration-damping effect is desired that depends on the axis of rotation of the electromotor, the damping device (10) will be formed with spring elements (11) extending across transition parts to the left around the one axis (8) and other spring elements (11) extending to the right around the second axis (9).

Claims

1. A drum drive comprising an essentially cylindrical drum that delimits an internal space intended for receiving an electromotor with a stator and a rotor for producing a rotating movement of the drum about a shaft (7) intended for being fixedly mounted on supporting elements, **characterised in** that the stator is turnably journaled about the shaft (7); that the motor comprises at least one resilient damping device (10) that is connected to the shaft (7) and to the stator and extends radially from the shaft (7) in a plane essentially at right angles thereto; and that the damping device (10) is intended for absorbing forces that strive to cause the stator to rotate about the shaft (7).
2. A drum drive according to claim 1, **characterised in** that the damping device comprises a centre element (11) configured for being fixedly connected to the shaft (7); and a connecting element (20a) configured for being connected to the stator; and that the spring element (31) exhibits a plane zigzag-shaped course in relation to a straight line (8) from the centre element (11) to the connecting element (20a).
3. A drum drive according to claim 2, **characterised in** that the damping device comprises at least one further spring element (31) with a plane zigzag-shaped course in relation to a straight line (9); and a connecting element (20b) configured for being connected to the stator; and that the spring elements (31) connecting the centre element (11) to the connecting element (20a) extend in the same plane as the first-mentioned straight line (8) under an angle in relation thereto.

4. A drum drive according to claim 2 or 3, **characterised in** that the spring elements (31) are arranged rotationally symmetrical about the centre element (11).
- 5 5. A drum drive according to anyone of claims 2-4, **characterised in** that the spring element (31) comprises segments (31) that extend more or less at right angles to said straight line (8,9) between the centre element (11) and the connecting element (20a, 20b).
- 10 6. A drum drive according to anyone of claims 3 to 5, **characterised in** that the segments (31) are connected to each other via transition parts (30) that extend approximately in parallel with said straight line (8 ,9).
- 15 7. A drum drive according to anyone of claims 3 to 6, **characterised in** that the longitudinal expanse of the individual segments (31) decreases towards connecting element (20a, 20b).
- 20 8. A drum drive according to anyone of claims 3 to 7, **characterised in** that the individual segments (31) have a transverse expanse that decreases towards the connecting element (20a, 20b).
9. A drum drive according to anyone of the preceding claims, **characterised in** that the spring element (31) is formed of plastics material.
- 25 10. A drum drive according to claims 1-9, **characterised in** that the spring element (31) is formed of metal or of a rubber material.

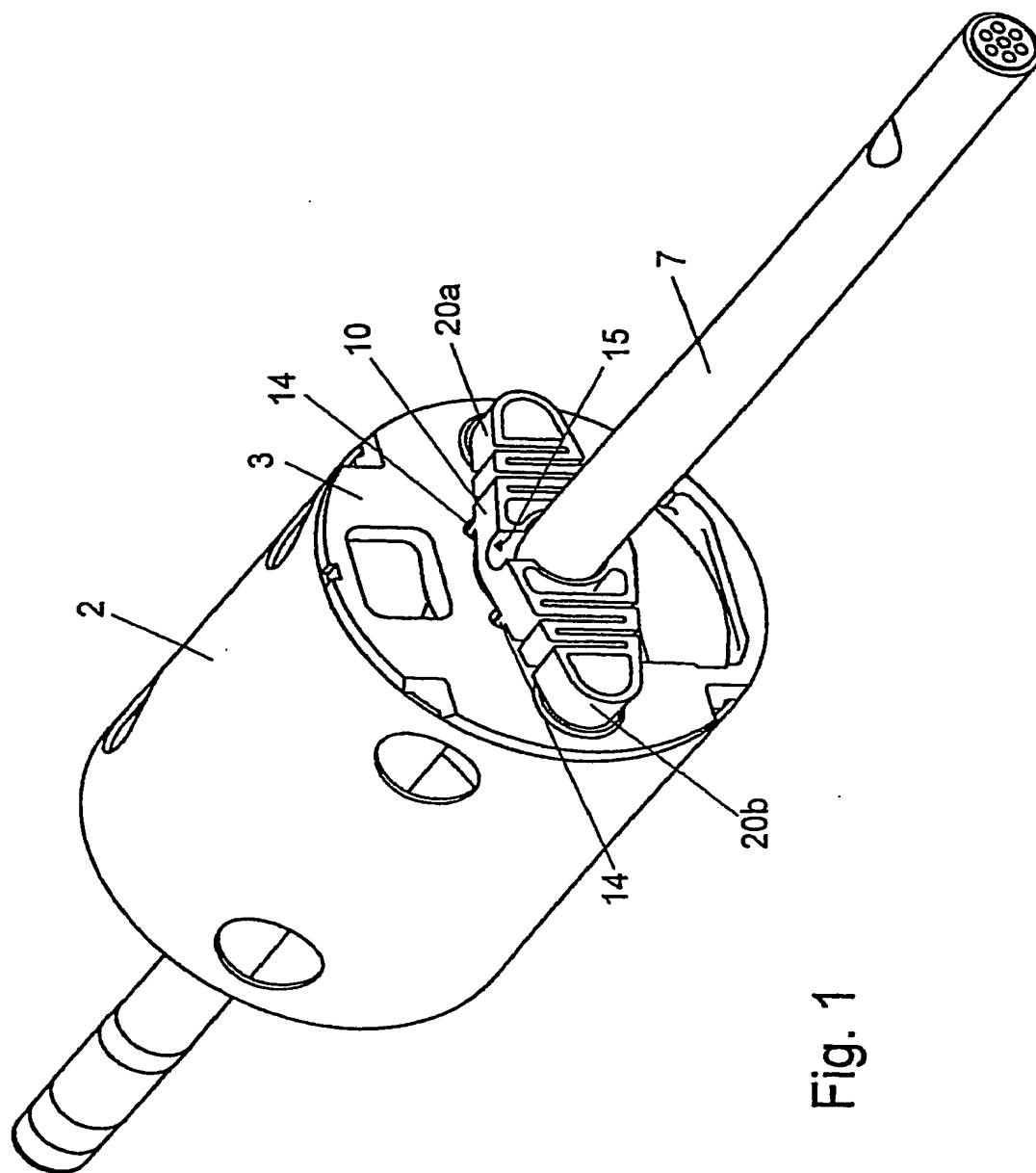


Fig. 1

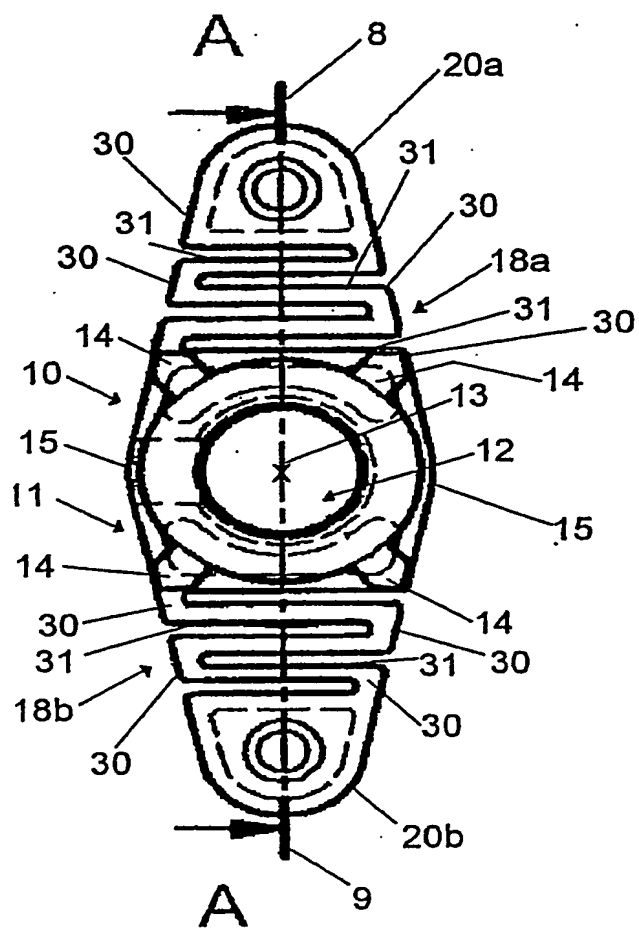


Fig. 2a

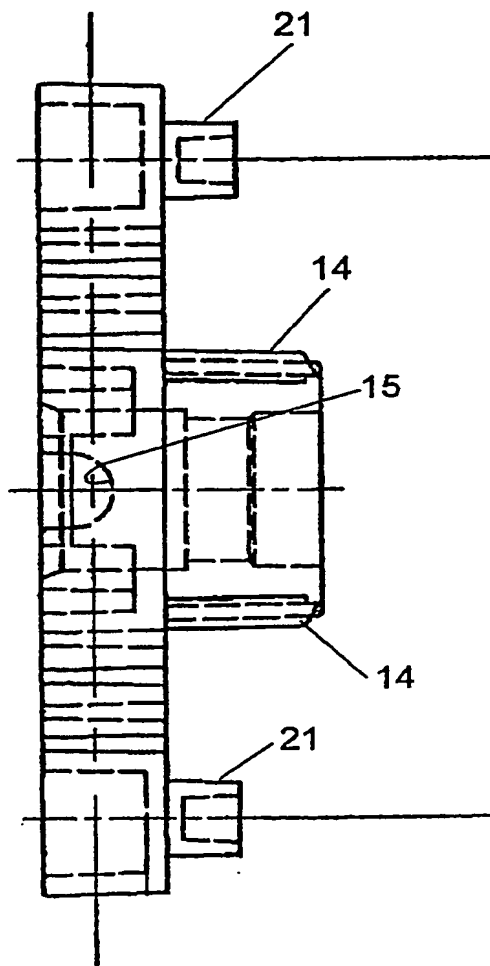


Fig. 2b

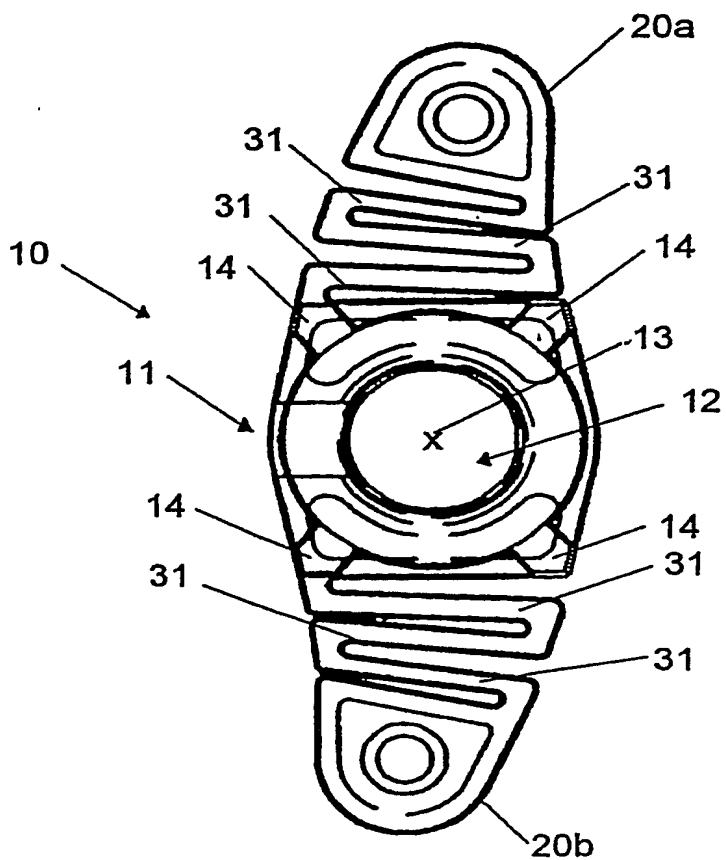


Fig. 3

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B65G23/08 F16F15/04 H02K5/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65G F16F H02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 7 511 303 A (ERIKSSON STIG) 10 April 1977 (1977-04-10) the whole document	1
A	US 5 798 887 A (KANEKO HISASHI ET AL) 25 August 1998 (1998-08-25) the whole document	1
A	US 6 402 653 B1 (JENSEN JAN S) 11 June 2002 (2002-06-11) figure 1	1
A	EP 0 942 192 A (WIFAG MASCHF) 15 September 1999 (1999-09-15) figure 10	2
	--- -/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

23 April 2004

Date of mailing of the international search report

12.05.2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

ANETTE RIEDEL/JAA

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	EP 1 375 872 A (SIEMENS AG) 2 January 2004 (2004-01-02) figure 3 ---	1
A	US 6 239 730 B1 (WENGER FABIAN) 29 May 2001 (2001-05-29) figure 2 ---	1
A	US 4 076 197 A (DOCHTERMAN RICHARD W) 28 February 1978 (1978-02-28) figures ---	
A	DE 43 24 912 A (BUEHLER GMBH NACHF GEB) 26 January 1995 (1995-01-26) figures -----	1

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
SE 7511303	A	10-04-1977	NONE	
US 5798887	A	25-08-1998	JP 3282406 B2 JP 8103050 A	13-05-2002 16-04-1996
US 6402653	B1	11-06-2002	DK 114897 A CA 2305135 A1 DE 69803477 D1 DE 69803477 T2 WO 9918369 A1 EP 1021664 A1	08-04-1999 15-04-1999 28-02-2002 19-09-2002 15-04-1999 26-07-2000
EP 0942192	A	15-09-1999	DE 19811098 A1 DE 59905903 D1 EP 0942192 A1	23-09-1999 17-07-2003 15-09-1999
EP 1375872	A	02-01-2004	EP 1375872 A1 JP 2004019948 A US 2004025609 A1	02-01-2004 22-01-2004 12-02-2004
US 6239730	B1	29-05-2001	SE 513113 C2 AU 1433300 A SE 9803856 A WO 0028667 A1	10-07-2000 29-05-2000 12-05-2000 18-05-2000
US 4076197	A	28-02-1978	CA 1052850 A1 DE 2727119 A1 FR 2355393 A1 GB 1577356 A IT 1074881 B JP 52155306 A	17-04-1979 29-12-1977 13-01-1978 22-10-1980 20-04-1985 23-12-1977
DE 4324912	A	26-01-1995	DE 4324912 A1 FR 2708159 A1 JP 7167330 A	26-01-1995 27-01-1995 04-07-1995